Virtual Atomic Emission Spectroscopy

## Objectives:

1. Observe the atomic emission spectra for various elements.
2. Use a virtual flame test to observe the color produced when metal ions are heated.
3. Identify unknown metal ions based on the results of a flame test.
4. Calculate frequency, wavelength or energy using the equation, E = λν.

## Procedure:

1. Click on the link to access the online spectroscopy lab: <http://mrpalermo.com/Virtual_Spectroscopy_Lab.html>
2. Write the name of each element located in Part I on the website into Data Table 1 below. Then click on each element and observe the line spectra that are produced. Draw lines under each letter representing the colors that you observe. (R-red, O-orange, Y-yellow, G-green, B-blue, V-violet)
3. Write the name of each metal ion located in Part II on the website into Data Table 2 below. Then click on each element to observe the color produced from the flame test. Record your results into Data Table 2. Using these results, click on the two unknowns and record their flame colors. Identify the name of each unknown metal ion based upon your flame test results.

### Data Table 1

|  |  |
| --- | --- |
| **Name of Element** | **Line Spectra Observed** |
|  | R O Y G B V |
|  | R O Y G B V |
|  | R O Y G B V |
|  | R O Y G B V |

### Data Table 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Element** |  |  |  |  |  |  |
| **Flame Color** |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Sample** | **Flame Color** | **Identity of Metal Ion** |
| **Unknown 1** |  |  |
| **Unknown 2** |  |  |
| **Unknown 3** |  |  |

### Questions

1. How are atomic emission spectra produced?
2. Why do larger gases such as neon produce more color bands (line spectra) than smaller gases like hydrogen?
3. Explain how colors in the flame test are produced.
4. How are the electrons “excited” in Part 2 of the experiment? What does it mean when the electrons are “excited”?
5. Explain why you did not see distinct lines when the metal salts were burned.
6. Rank the colors in the visible spectrum from highest energy to lowest energy.
7. Calculate the frequency (in s-1) and the energy (in Joules) for wavelengths from the element neon in the table below. You will first need to convert nm to m. Then use the following equations to make your calculations:

c = λν (c = 3.00 x 108 m/s)

E = hν (h = 6.63 x 10-34 J-s)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ELEMENT** | **Wavelength (nm)** | **WAVELENGTH (m)** | **FREQUENCY (1/s)** | **ENERGY (J)** |
| Neon | 475 |  |  |  |
| Neon | 525 |  |  |  |
| Neon | 580 |  |  |  |
| Neon | 620 |  |  |  |
| Neon | 705 |  |  |  |